

The Reliability and Forecasting Value Of Advance Estimates of Retail Sales

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Many business economists rely heavily on retail sales data to analyze and forecast changes in economic activity. They have good reason to do so. Cycles in retail sales usually closely parallel those of the economy as a whole, and turnabouts in retail sales volume sometimes precede changes in the direction of overall economic activity. For example, retail sales, adjusted for inflation and seasonal differences, peaked in the first quarter of 1973, three quarters before the prerecession peak in the nation's output of goods and services. Furthermore, retail sales bottomed out in the fourth quarter of 1974, a quarter before the recession's trough. Such examples show why those who follow the economy and its outlook are justified in keeping track of retail sales.

There is some question, however, of the reliability of the first estimates of weekly and monthly retail sales. These "advance" estimates are released only a few days after the week or month in question. Because of their timeliness, advance estimates attract a lot of attention, even though the surveying agency, the Bureau of the Census, cautions against inferring too much from week-to-week or month-to-month changes in sales volume. But, while some business analysts seem to have a great deal of confidence in advance estimates, others shun the figures completely. The real

usefulness of these early reports of retail sales is surely somewhere in between these extremes.

Following a brief discussion of the data being considered, this article summarizes the results of some statistical tests of the reliability and usefulness of advance estimates of retail sales. Because publication of the advance estimates for March 1970 through January 1972 was suspended, this article examines only the data from February 1972 through December 1976, during which time a modified, and presumably improved, procedure has been used in arriving at advance estimates of retail sales.¹

RETAIL SALES DATA

Retail sales are the revenues of stores that primarily sell merchandise to the general public for personal or household consumption. Such stores and certain nonstore establishments such as mail order houses are defined to be engaged in retail trade, and all of their revenues are counted in retail sales. This includes revenues from the sales of used as well as new merchandise, from sales to governmental units and to other businesses as well as to consumers, and from sales of services "incidental to the

¹ "Development of Advance Estimates of Monthly Retail Sales," September 1976 Supplement to *Advance Monthly Retail Sales*, Bureau of the Census, U.S. Department of Commerce, p. 1.

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sale of goods." Establishments that sell primarily services, however, are not included. Thus, total consumer spending on new goods and services differs from total retail sales in several ways.

Despite these differences, the sales of retail stores are an excellent indicator of the strength of consumption demand because retail sales are predominantly of new goods to consumers and because changes in consumer demand generally show up the most in purchases of goods. The strength of consumer expenditures is, of course, of key importance in the economy as a whole, and therein lies the case for keeping close tabs on consumers in general and for tracking retail sales in particular.

The Business Division of the Bureau of the Census, U.S. Department of Commerce (referred to hereafter as Census), collects monthly data on retail trade from a sample of approximately **22,000** retail firms operating a much larger number of retail stores. A subsample of 2,500 firms, representing about **48,000** stores, reports on a weekly basis. Given the budget and time constraints under which it must operate, Census has carefully designed these samples and selected statistical techniques to yield the best possible estimates of retail sales in the country as a whole, by region, and by type of business. Procedures are continually reviewed and modified.

Advance estimates of retail sales are based on reports from the weekly reporting panel. Advance estimates do not come out in advance of the sales period covered, but in advance of the more reliable preliminary estimates. The preliminary estimate for retail sales in a particular month is based on reports from the large panel of retail firms. It comes out one month after the advance figure. Another month later, a final estimate is published. The final estimate is more reliable than the preliminary estimate because it is based on a larger sample of reports. This is because most firms in the monthly retail sales panel do not report every

month, but take turns reporting two months of data.²

While the differences in advance, preliminary, and final estimates of monthly retail sales are related to sample size, this is not the case for weekly retail sales, except in a limited sense. Sample data on weekly retail sales are gathered only once, in the reports of the weekly reporting panel. First published as advance estimates, the weekly figures are later revised to preliminary and then to final estimates only in reflection of more up-to-date and reliable monthly estimates used in their calculation. Such revisions affect the size but not the pattern (the absolute but not the relative values) of retail sales within a given month. For example, if the advance estimate of retail sales in a particular week is one-third of **advance-**estimated sales in the month containing that week, that relationship will be the same for the preliminary and final estimates for that week. This means that questions about the differences between advance, preliminary, and final weekly retail sales estimates are answerable with reference to differences in certain monthly estimates.³

² A detailed explanation of sampling procedures is contained in each **Monthly** Retail Trade report (Census).

³ The calculations for advance, preliminary, and final estimates of retail sales nationwide during a particular week all begin with the sales reported by the panel for that week. This figure is then multiplied by the inverse of the latest estimate of the weekly reporters' share of sales across the country. For example, if at latest estimate the weekly panel accounted for 5 per cent of **U.S.** retail sales, its reported sales for the most recent week are multiplied by $1/.05 = 20$ to arrive at an estimate of retail sales in the nation as a whole (actually, these calculations are done on a kind-of-business basis, then summed to obtain an estimate of total retail sales). When the panel's reports for a week first come in, the latest estimate of its current share of retail sales is provided by dividing its sales in the previous month by the advance estimate of **U.S.** sales in that month. The product of the inverse of this figure and the panel's sales **in the** past week yields the advance estimate for that week (after slight modification for anticipated statistical bias). A better estimate of the panel's current share of **U.S.** sales is possible when the advance estimate for the month containing the week in question becomes available. Thus, after weekly data for the whole month are in, Census makes

WEEKLY ESTIMATES

One way to evaluate the reliability of advance estimates is to compare their record with the later-appearing preliminary and final estimates. In the case of weekly estimates, however, comparison of the advance figures with their two revisions amounts to comparing monthly estimates, as noted previously. Such comparisons are summarized in the next section. But something still can be said about the usefulness of weekly estimates.

Weekly retail sales figures may be used in many ways, but the only use considered here is economic forecasting. To the degree that monthly retail sales estimates are useful in this respect, weekly estimates also may be considered useful if they 'provide an early indication of monthly sales trends.' This suggests using the advance estimate of retail sales for the first one or two weeks of each month to forecast sales for the month as a whole.

Data are not published by part weeks or for a particular number of days (e.g., the first 7 or 10) in a month. Therefore, to test the

preliminary estimates of retail sales for the weeks in the past month. **The final** estimate of sales in a particular week differs from the preliminary estimate only in that the final, instead of advance, estimate for sales in the month containing that week is used in the calculation.

⁴ Shortly after the end of the month, one could get a first measure of total sales in that month by summing up the weekly advance estimates for that month. But this would not be of much value in forecasting, as very soon thereafter the advance estimate for that month would be available. The advance estimate for a particular month, it might be noted, is not the sum of the advance weekly estimates for the weeks and part weeks in that month, although the difference will usually be quite small. While the advance weekly estimates are based on the same panel of reporters as the advance monthly, the advance weekly estimates are often based on early estimates by respondents, some of whom (particularly automotive dealers) do not keep books on a weekly basis. There is also a difference in formulas: the advance weekly figure is calculated using the previous month's advance monthly estimate (see footnote 3), while the advance monthly estimate is calculated using the previous month's preliminary estimate.

dependability of sales estimates in forecasting, sales during the first full week in the month were selected as a rough and ready predictor of sales **during** the rest of the month, despite the obvious drawback that the first full week can end anywhere from the 7th to the 13th of a month. The data were adjusted for seasonal variation and trading day differences, but not for price changes (trend was removed). The relationship was found to be fairly strong, considering the many factors that might affect the pattern of sales within a month (e.g., unseasonable weather). Although the results showed that sales during the first full week of a month are a fairly stable proportion of those during the rest of the month, the ratio varies too much to be of much forecasting value. The findings indicate that, in 95 per cent of such forecasts, the advance monthly total will be within 3 per cent of the forecasted value. This is a wide range. But, even with this rough and ready predictor, there is a gain, a better forecast of monthly retail sales than obtainable without weekly data.

Several attempts were made to improve the forecasting value of the first full week of retail sales in each month. The sales data were adjusted for inflation, and relationships between percentage changes were investigated. Although these efforts were unsuccessful, two results are worth reporting. First, month-to-month percentage changes in advance monthly estimates are poorly forecast by percentage changes in sales from the first full week in one month to the first full week in the next. Second, however, when percentage changes from corresponding year-earlier figures are used, the forecasting value is considerably improved, especially when the sales data are in real terms (adjusted for price changes).

Other statistical inquiries are suggested by the comparisons that Census makes in its report of weekly retail sales. These include the percentage changes in the last week's sales from the preceding week and from the

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corresponding week a year earlier, and the percentage change from a year earlier in sales in the four most recent weeks combined. The type of test implied by these comparisons is one which checks the usefulness of lagged values of weekly retail sales as forecasters of weekly retail sales.

Retail sales in the current week are highly correlated with those in the previous week for the **1973-76** period. But this finding is not useful, as it only confirms the apparent upward trend in sales. More interesting is the question of whether or not rates of growth of weekly retail sales are likely to be maintained from one week to the next. For the data period covered, the answer is no: in fact, the correlation between the latest week's percentage increase in sales with that recorded by the previous week is negative. That is, when sales one week show an above average gain over the previous week, it is likely that the next week's increase will be less than average.

The fact that a change in the rate of increase in retail sales is not maintained from one week to the next does not mean that such changes are useless indicators. A significant relationship was found, for example, between the percentage increase in the latest week and the rate of increase of retail sales over the next four weeks. This gives some support to the notion that retailers are justified in being more optimistic in their outlook the greater has been the most recent week-to-week percentage change in sales.

Year-over-year percentage changes, in individual weeks or in the sales of four weeks combined, also yielded results consistent with the view that weekly retail sales data are worth considering in forecasting trends in sales. In every instance, however, the standard error of forecast was too large to permit much confidence in the forecasting of the trend within a small range. Thus, while data on weekly retail sales provide some basis for tentative forecasts about increases or decreases

in trend, that is about all they provide. As much is implied by the words of caution Census includes in its weekly report of retail sales.

In summary, weekly retail sales data are judged useful in economic forecasting; just how useful will depend on the criteria of the forecaster, and in particular, in how often he must forecast.

MONTHLY ESTIMATES

In the case of advance monthly estimates of retail sales, questions of reliability as well as of usefulness are appropriate, as noted earlier. Indeed, even final estimates are just estimates, and their reliability is carefully checked by Census periodically.⁵ Only the reliability of advance estimates is considered here, however, by way of comparison with the reliability of preliminary estimates.

Census has recently published statistics comparing advance and preliminary estimates of monthly retail sales covering the years **1974** and **1975**.⁶ These statistics show, as expected from the differences in sample sizes, that the preliminary estimate is a better estimate of the final estimate than the advance estimate is of the preliminary—better, that is, in having a smaller average absolute error and in having a smaller standard deviation. For purposes of this article, this "dollar-level comparison" was repeated for an expanded time period, February **1972** through November **1976**. The results were the same as those reported by Census, although dividing up this period into three parts indicated a slight improvement in

⁵ Estimates of sampling variabilities are published in *Monthly Retail Trade, Sales and Accounts Receivable* (Census). Sampling variabilities, however, do not explain the 4.8 per cent difference between retail sales in 1972 as reported in the 1972 Census of Retail Trade and as estimated by the Census Bureau's monthly survey of retail trade. Consequently, a comprehensively revised monthly survey is now in preparation and expected to be operational at Census soon.

⁶ "Development of Advance Estimates . . . ," pp. 5-10.

the reliability of the advance estimates in the past 18 months.

For purposes of economic forecasting, the more interesting comparison is of the trends indicated by the advance and preliminary estimates. The advance estimate of the past month divided by the preliminary estimates of the month before is the first available estimate of the monthly trend in retail sales. The second estimate is available a month later, in the form of the ratio of the preliminary estimate for the most recent month to the final estimate of the month before. The sampling variability of the differences in these trend estimates gives the forecaster something to go on in deciding how much weight to give to advance estimates. For the period February 1972 through November 1976, the standard deviation of the trend difference was 0.8 per cent for total retail sales, the same as reported by Census for the shorter period. According to sampling theory in statistics, this means that the advance trend estimate plus or minus 0.8 per cent will contain the preliminary trend estimate about two-thirds of the time. For example, the advance trend estimate reported in January 1977 was 3.1 per cent, the percentage increase in December 1976 sales (seasonally adjusted advance estimate) over November 1976 sales (seasonally adjusted preliminary estimate). At the time of that release, a forecaster would be justified in believing that the chances were two out of three that the preliminary trend estimate available a month later would be between 2.3 per cent and 3.9 per cent (3.1 ± 0.8). As it turned out, the preliminary trend estimate released in February 1977 showed a 3.9 per cent increase, as measured by the percentage increase in December 1976 sales (seasonally adjusted preliminary estimate) over November 1976 sales (seasonally adjusted final estimate).

Comparisons also can be made between the advance trend estimate, explained above, and the final trend estimate, as measured by the percentage change in final monthly estimates.

Over the survey period of 54 months, the advance trend estimate differed from the final trend estimate by more than 1 per cent a total of 13 times. In six of these instances, the **advance** trend estimate missed the direction of change of retail sales, as ultimately measured by the final trend estimate.

Chart 1 shows the strong trend built into retail sales by inflation. In constant dollars, it is interesting to note, retail sales are just now getting back to their prerecession peak of early 1973.⁷ The difference in the charted lines suggests making trend comparisons with **price-adjusted** data. When this was done, the advance and preliminary trend estimates of real retail sales turned out to be not quite as good as corresponding estimates of retail sales in current dollars, in the sense that for the real case, the final trend could not be as confidently estimated to lie within a particular range of the estimated value.

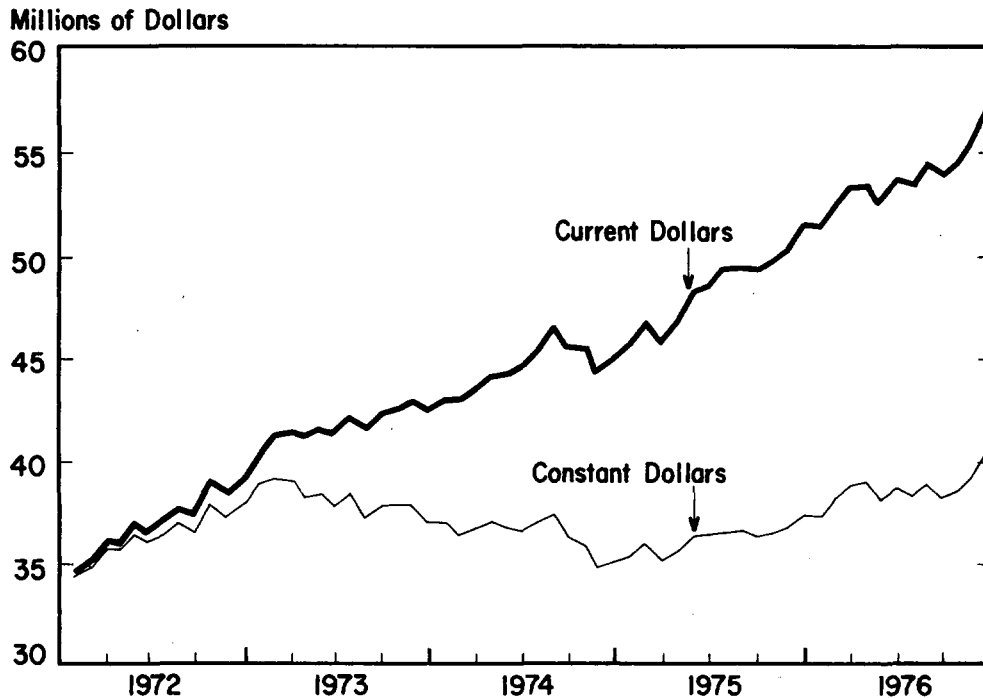
Early estimates are not really forecasts of what is being measured. But an advance trend estimate could be used to forecast rates of change in sales in coming months. As was the case for week-to-week changes, however, the rates of change in monthly retail sales tend to be negatively related in successive months. In fact, for the February 1972 to November 1976 period, there was little consistent association between one month's rate of change in real retail sales and the rates recorded in each of two preceding months. Over longer periods, however, trends in retail sales are established, as is evident from the chart.

SUMMARY AND CONCLUSION

This article has reported on several tests of the reliability and forecasting value of advance

⁷ These data are not available from Census, so current dollar sales were divided by the commodities component of the Consumer Price Index to yield a quick and probably not too bad measure of real retail sales by month. (Quarterly retail sales data carefully adjusted for price changes are published from time to time in the *Survey of Current Business*.)

Chart 1
MONTHLY RETAIL SALES



SOURCE: Department of Commerce.

weekly and monthly estimates of retail sales. On the basis of these tests, it is concluded that advance estimates are useful to the business analyst. But care must be taken in drawing conclusions about future trends from data from one to two weeks or months. Even if these advance estimates were error free, forecasts of retail sales would be difficult, as economic magnitudes do not generally grow in a nice regular fashion. On the other hand, meaningful

statements can be made about trends in sales using advance estimates if probable error is taken into consideration. As Census puts it, "Knowledge of these measures can serve as a guide for the use of the estimates and helps to demonstrate the need to base decisions on data that cover more than one month."

⁸ "Development of Advance Estimates . . .," p. 7.